

REMARKS

Reconsideration of this application is respectfully requested.

Applicant traverses the examiner's rejection. As previously submitted, claim 13 recites a piston ring having an HVOF-applied layering on its operating face with a surface roughness factor $R_k < 0.12\mu m$ and a porosity <5%. Claim 13 further recites at least one of the upper and lower faces of the ring as having a trapezoidal form adjacent the operating surface provided with a galvanic protective layer.

As noted in the previous response, the distinction of the very low porosity level <5% coupled with the surface roughness factor $R_k < 0.12\mu m$ of the HVOF-applied layering is believed critical since they act together to prevent the penetration of corrosive electrolytes that the layering gets exposed to when the galvanic protective layer on one or both top and bottom faces of the piston ring is applied. The <5% porosity and surface roughness factor $< 0.12\mu m$ combine to prevent the penetration of the acidic electrolyte into the layering on the operating face, particularly given the trapezoidal form of at least one of the upper and lower faces to which the galvanic protective layer is applied. This is not simply a workable or optimal range discoverable by routine experimentation, but rather, is believed to be a necessary feature to hinder electrolytes from being retained in the surface capillaries of the operating surface layer, which if not prevented, would cause surface damage of the operating surface layer, as clearly expressed in applicant's specification.

Neither JP '048 or Obara teach or suggest controlling the porosity and surface roughness factor R_k at the level claimed to achieve the desired resistance to the penetration of acidic electrolyte during galvanic application of the chrome layer on the upper and lower faces. The only specificity given to surface factors is provided in Obara, where it is mentioned that the porosity of the thermal spray coating 3 be less than 4% by volume, and where a nitriding treatment is conducted after the thermal spray coating, the porosity is preferably 1.5% or less by volume (paragraph [0045]). Further, as noted by the examiner, it is mentioned the surface roughness be as smooth as possible, and preferably have a surface roughness (**10-point average roughness R_z**) of $4\mu m$ or less (paragraph [0047]). However, as further acknowledged by the examiner, Obara is silent as to a surface roughness factor **R_k** . And so, the examiner has drawn the conclusion that

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because the stated **Rz** value is 4 μm or less that it would be obvious for one skilled in the art to arrive at the claimed **Rk** value of 0.12 μm or less, apparently because Obara prescribes as smooth a surface as possible, as it pertains to an **Rz** value. This conclusion is believed to be without merit. The stated **Rz** value of Obara is an average maximum height of the surface profile, which is obtained by calculating the average height difference between the 5 highest peaks and the 5 deepest valleys. This is not analogous to the **Rk** value being claimed, which is the core roughness depth of a surface. The **Rk** surface is the bearing surface provided after run-in, such that upon run-in, the peaks (**Rpk**) have been worn, leaving the running surface plateaus **Rk** which are spaced by lubricant retaining valleys. Thus, the **Rk** surface value is the difference between the maximum peak (**Rvk**) and the minimum valley (**Rvk**), for which, there is no correlation based on the **Rz** value disclosed in Obara. In addition to Obara, none of the other references mentioned by the examiner teach or suggest the **Rk** surface roughness value claimed by applicant, but only give mention to **Ra** (mean surface roughness) and **Rz** values, both of which are not analogous to the claimed **Rk** value.

Accordingly, claim 13 is believed to define patentable subject matter and to be in condition for allowance. Such action is respectfully requested.

Claims 14-17 and 21-22 are ultimately dependent upon amended claim 13, and thus are believed to recite patentable subject matter for at least the same reasons.

Claim 23 recites a method for making a piston ring, including providing an operating surface of the ring having a porosity less than 5% and a surface roughness factor **Rk** being less than 0.10 μm as measured in an axial direction. Accordingly, for at least the same reasons given above in support of amended claim 13, it is respectfully submitted that claim 23 distinguishes applicants invention patentable over JP '408 alone or in combination with Obara and should be allowed.

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It is believed that this application now is in condition for allowance. Further and favorable action is respectfully requested.

The Patent Office is authorized to charge or refund any fee deficiency or excess to Deposit Account No. 04-1061.

Respectfully submitted,

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Date

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